**February 7, 2005**

**VIA ELECTRONIC FILING**

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, SW, Room TW-A325
Washington DC, 20554

**Re:** ***Ex Parte Submission***
2002 Biennial Review Proceeding -- WT Docket No. 03-264

Dear Ms. Dortch:

CTIA-The Wireless Association™ ("CTIA") submits the following in further support of its October 20, 2004, proposal to modify base station Equivalent Isotropically Radiated Power ("EIRP") limits contained in Parts 24 and 27 of the Commission's rules. CTIA has proposed that the Commission supplement the current EIRP limits to facilitate deployment of wideband technologies and eliminate disadvantages for certain narrowband technologies. CTIA's proposal: (i) does not result in higher average power than allowed under current rules; (ii) does not increase the risk of interference to nearby licensees; and (iii) does not modify the Commission's RF exposure limits. It represents a compromise of proposals submitted previously in this proceeding by various CTIA member companies.[1]

CTIA's proposal is supported by carriers and manufacturers across technology platforms. In the *2002 Biennial Review NPRM*, the Commission sought comment on modifying base station EIRP rules based on power spectral density – exactly what CTIA is now requesting.[2] The Commission, therefore, should act expeditiously and grant CTIA's requested relief in its upcoming *2002 Biennial Review Report and*

[1] *See, e.g.*, Comments of Motorola, Inc., *In the Matter of Biennial Regulatory Review – Amendment of Part 1, 22, 34, 27, and 90 to Streamline and Harmonizing Various Rules Affecting Wireless Radio Service*, WT Docket No. 03-264 (filed Apr. 23, 2004) ("Motorola Comments"); Comments of Qualcomm Incorporated, *In the Matter of Biennial Regulatory Review – Amendment of Part 1, 22, 34, 27, and 90 to Streamline and Harmonizing Various Rules Affecting Wireless Radio Service*, WT Docket No. 03-264 (filed Apr. 23, 2004) ("Qualcomm Comments"); Comments of Ericsson Inc., *In the Matter of Biennial Regulatory Review – Amendment of Part 1, 22, 34, 27, and 90 to Streamline and Harmonizing Various Rules Affecting Wireless Radio Service*, WT Docket No. 03-264 (filed Apr. 23, 2004) ("Ericsson Comments"); Comments of Cingular Wireless LLC, *In the Matter of Biennial Regulatory Review – Amendment of Part 1, 22, 34, 27, and 90 to Streamline and Harmonizing Various Rules Affecting Wireless Radio Service*, WT Docket No. 03-264 (filed Apr. 23, 2004) ("Cingular Comments"); Letter from Ray Strassburger, Nortel Networks, to Marlene H. Dortch, FCC, filed March 5, 2004.

[2] *See Biennial Regulatory Review – Amendment of Parts 1, 22, 24, and 90 to Streamline and Harmonize Various Rules Affecting Wireless Radio Services*, WT Docket No. 03-264, 19 FCC Rcd 708, para. 18 (2003) (*2002 Biennial Review NPRM*).

*Order*. In this submission, CTIA responds to certain questions raised by Commission staff.[3]

**CTIA's Proposal.** CTIA recommends that EIRP for PCS licensees be limited to the larger of either: (1) the current rules; or (2) a power spectral density constraint that facilitates deployment of new technologies. Specifically, CTIA recommends that base stations be limited to the greater of 1640 watts average EIRP per carrier or 3280 watts/MHz average EIRP for antenna heights of up to 300 meters HAAT. For rural areas, the EIRP limits would be increased to 3280 watts average EIRP per carrier and 6560 watts/MHz average EIRP, respectively. CTIA recommends that the per-MHz constraints for antennas above 300 meters be set at 1640 watts. CTIA also requests that the Commission eliminate the 100 and 200 watt base station transmitter output power limits in section 24.232(a) and (b) of the Commission's rules. Given the proposed limits on EIRP, this absolute power limit adds no real interference protection and may restrict the efficient use of state-of-the-art technologies. To ensure regulatory parity for technically like services, CTIA proposes that the Commission mirror these rule changes in section 27.50(d)(1) of its Advanced Wireless Service rules.[4]

**The Need for the CTIA Proposal.** The current EIRP base station limits force carriers utilizing wider carrier channels to operate wideband carriers at lower total power than is allowed for multiple narrower-bandwidth carriers. In essence, the costs of deployment for wider carrier channels are increased without any corresponding improvements to service quality and/or coverage. These additional costs are especially problematic for carriers attempting to deploy wideband technologies – particularly in rural areas. Such costs ultimately are flowed through to consumers.

The current EIRP limit is interpreted to place a limit on the power of a single carrier but to permit multiple carriers to be transmitted from a single base station. Systems operating in smaller bandwidths are permitted to operate at higher power spectral density than those operating in larger bandwidths. Technologies, such as CDMA, WCDMA, or OFDM, that combine many voice signals onto a single combined signal and that use advanced techniques to counter multi-path fading therefore are disadvantaged by the per-carrier power constraint in the current rules. Removing an artificial handicap on the use of some technologies — such as WCDMA –would facilitate the adoption and deployment of these technologies by wireless service providers. Moreover, researchers and inventors would no longer be constrained to give up power in order to use wider bandwidths. As illustrated in the figures below, a hypothetical system operating over 1.0 MHz could have five times the power density of a system operating over 5.0 MHz.

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[3] *See* Letter from Paul W. Garnett, CTIA—The Wireless Association™, to Marlene H Dortch, FCC, filed January 13, 2005.

[4] *See* 47 C.F.R. § 27.50(d)(1).

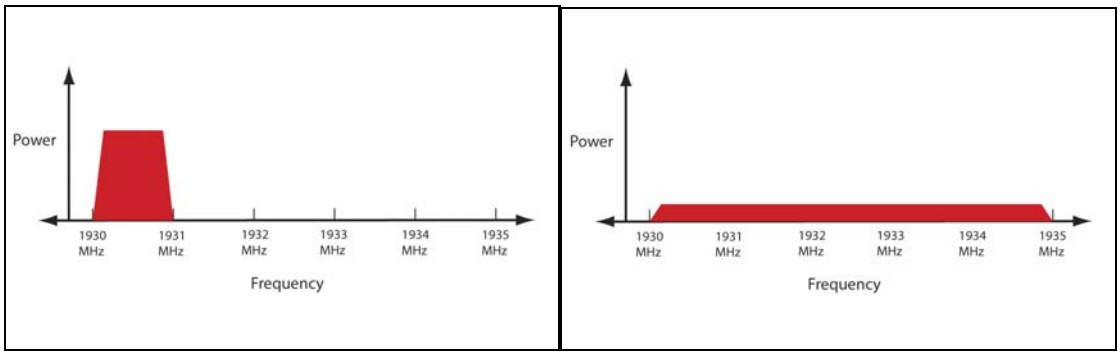


**Figure 1. Hypothetical Systems Operating in 5.0 MHz vs. in 1.0 MHz**

The illustration below contrasts permitted and prohibited configurations under the current EIRP limits in Part 24. One can easily see that there should be little or no difference in the interference created by the two configurations. They have essentially identical patterns of spectrum occupancy. The essence of CTIA's proposal is that the prohibited configuration should be permitted.

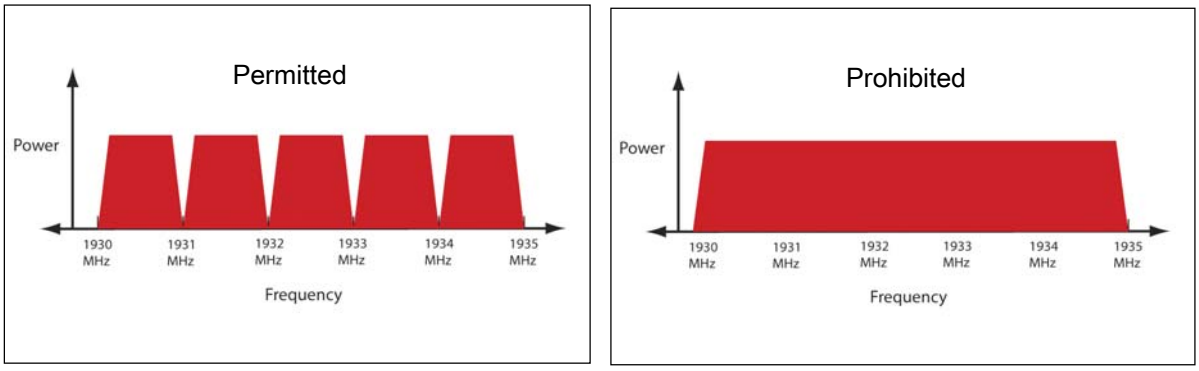


**Figure 2. Permitted and Prohibited Configurations**

CTIA notes that wider bandwidth cannot make up for decreased power. Consequently, the current rules erect a barrier to innovation in wideband designs. One might think that spreading a signal over a wider bandwidth would provide additional processing gain that could be used to wring additional capacity out of the wireless channel—thereby compensating for the loss in power spectral density. However, that is not the way processing gain contributes to system performance. Additional processing gain from wider bandwidth operation will improve the performance of a spread-spectrum system in the presence of a jamming signal.[5] But,

[5] *See* Proakis, *Digital Communications* 4th Edition, McGraw Hill, at pp. 738–740 or Rappaport, *Wireless Communications* 2nd ed, Prentice-Hall, at pp. 331–333.

a critical assumption behind this improvement is that the power of the jamming signal is fixed. However, that assumption does not always hold. Specifically, that condition would not hold at the edges of many of the coverage cells in which a wireless service provider would need to use a maximum EIRP signal. Rather, the noise and interference in the wider channel would increase as the signal bandwidth increased in direct proportion to the wider bandwidth—exactly canceling out the increased processing gain. Another way to say this is that, under the current rules, the signal power at the edge of the cell is unchanged but the equivalent noise bandwidth (and interference) is increased as the bandwidth is increased. Thus, the signal to noise ratio is decreased. To keep the signal to noise ratio constant the signal power must also be increased (*i.e.*, move to power spectral density limits).

**Multi-carrier Amplifiers.** Closely related to this request is a request that the FCC permit the use of multi-carrier amplifiers at wireless base stations. Consider a representative base station with five separate carriers all transmitted over the same antenna at maximum EIRP. Rather than have five separate power amplifiers each boosting one of the separate carriers to its allowed power limit and then combining those five carriers for transmission, it might be more efficient to combine low-power versions of the five carriers and amplify that combined signal for transmission. If the amplifiers were perfect devices, then the transmitted waveform would be exactly the same in the two cases. However, the current EIRP rule constrains the EIRP associated with a single amplifier. Consequently, one alternative is permitted; the other prohibited.

Changing the EIRP limit to permit such multi-carrier amplifiers would be sound public policy, and CTIA supports such a change. Changing the EIRP limit to permit multi-carrier amplifiers is only a partial step toward permitting efficient use of modern technology. The CTIA proposal would permit the use of multi-carrier amplifiers as well the use of wideband modulation technologies without degrading or disadvantaging deployment of wideband technologies.

**Measurement Issues—Occupied Bandwidth.** Obviously, the CTIA proposal requires a method for measuring the power spectral occupancy of a PCS signal. The Commission is familiar with this task, having had occasion to deal with it in many circumstances. For example, section 24.338 of the rules describes a measurement process for determining the transmitted energy in a 1.0 MHz bandwidth.[6] Similarly, section 25.252 specifies a measurement process for determining the transmitted energy in a 1.0 MHz bandwidth.[7]

CTIA suggests that the following procedure, based on that in section 25.252, would be appropriate for measuring the spectrum occupancy of a PCS signal.

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[6] 47 C.F.R. § 24.338.
[7] 47 C.F.R. § 24.252.

Specifically,

> The wideband EIRP level is to be measured using a root mean square (RMS) detector function with a resolution bandwidth of 1 MHz or equivalent and the video bandwidth is not less than the resolution bandwidth. The measurements are to be made over a 20 millisecond averaging period when the base station is transmitting.

CTIA recognizes that other procedures may also be appropriate and merely offers this as one alternative. CTIA reemphasizes its belief that imposing a limit on the power spectral density in every contiguous 1 MHz region in the relevant band is more appropriate than a stepped limit—say one that applied a limit on the total power in a wider region such as 5 MHz.

**Measurement Issues—Peak Versus Average EIRP.** The current Part 24 and 27 EIRP rules limit the peak EIRP from a base station. The term *peak* is subject to interpretation and may lead to confusion. The Commission has allowed a reasonable interpretation of this language in the past—in effect basing PCS transmitter power on the average power measured over a period of perhaps a millisecond or so.[8] Ericsson summarized the situation well in its comments:

> Moreover, this change [replacing *peak* with *average* in the EIRP limits] will make the rule very much independent of the radio access technology used. An average measurement will provide more accurate and relevant information on output power than a peak measurement for technologies that have non-constant envelope signals such as W-CDMA or CDMA 2000. For these noise-like waveform technologies, a peak measurement does not provide the information needed to determine the power in the entire band and is not at all representative of the output power. This may be why the FCC allows average measurements in practice, since average measurements provide more accurate information for non constant envelope technologies.[9]

CTIA recognizes that the concern about *peak* versus *average* is logically separate from adopting an EIRP limit based on power spectral density. However, because the two issues arise in the very same sentence of the rules, CTIA believes that replacing *peak* with *average* or simply removing *peak* (and thereby conforming the form of the EIRP/ERP limits in Parts 22 and 24) would remove the uncertainty associated with use of the term *peak* in the current rules. CTIA notes, as does

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[8] The use of *peak* and *average* in this context is complicated by definitional issues. A signal comprised of two equal power sinusoidal waves each of 1 watt power can be regarded as either (1) a constant 2 watt signal or (2) a signal with power varying between 0 watts and 4 watts as the sinusoids come into phase and go out of phase. From the point of view of controlling radio interference, view (1) is usually correct; from the point of view of the designer of base-station power amplifiers, view (2) is usually correct.

[9] Comments of Ericsson Inc. in WT Docket No. 03-264, at p. 11 (Apr. 23, 2004).

Ericsson in the above quoted text, that the wording change that CTIA proposes would not lead to a change from current practice. The suggested rewording simply corrects the wording of rule to properly reflect current practice for measuring base station EIRP levels. A 10-watt PCS base station today would remain a 10-watt transmitter after the proposed rule change. Thus, CTIA recommends that the period over which such averaging occurs be relatively short.

One might naturally wonder if the very short peaks that occur with multi-carrier waveforms such as CDMA and OFDM require separate control—such as a limit on the peak-to-average ratio. CTIA sees no need for such a limit in this context—no more than a peak EIRP limit need be imposed on a waveguide that is carrying multiple TDMA carriers to an antenna. In either case, the "peak" power may be higher than the "average" power but the average power provides a good measure of the interference potential of the signal. Consider that a multicarrier amplifier with five GSM carriers will have a "peak" power five times higher than the average power when all five carriers add in phase. But, the interference properties of those five carriers will be unchanged from what it would have been if it had been generated by five separate amplifiers each with a peak-to-average ratio of unity. The peak power in multicarrier waveforms is of the same form.

**Risk of Increased Interference.** CTIA is confident that its proposal does not create any significant risk of increased interference. It is important to note that the carriers who support this consensus position operate the very co-channel and adjacent channel systems that would be most subject to interference if operation under the proposed rules created the potential for increased interference. Such carriers have corresponding incentives to minimize the need for coordination with one another to prevent interference on each other's system. Their support for the CTIA proposal indicates that the Commission can be highly confident that the proposal poses negligible risk of increased interference. In addition, this proposal will not allow higher powers than already are permitted today. A TDMA system with a seven-cell reuse pattern and omnidirectional cells could operate at more than twice the power–per-MHz than is permitted by the power spectral density limit proposed here. Existing systems pose intermodulation and OOBE threats as severe or more severe than those that would be created by new systems authorized pursuant to the proposed rules.

**RF Exposure Limits.** CTIA sees no connection between its proposal and the RF exposure limits. CTIA's proposal does not address or suggest modifying the Commission's current RF exposure rules. The maximal exposure scenario under CTIA's proposed rules is the same as exists today. The maximal exposure scenario is that in which a base station transmits multiple narrowband carriers at maximum EIRP and two or more carriers are packed in each MHz. It is instructive to recall that the earlier opposition by several parties to the concept of a power spectral density-based EIRP limit was that such a limit would require *lowering the power of existing*

*systems.* CTIA's proposal avoids this concern by allowing such systems to continue operating at the higher powers allowed under the current rules.

**Other Rule Sections.** CTIA does not see the need, at this time, for modification of the current field strength limits at service area boundaries to limits based on power-spectral densities. Coordination procedures between neighboring systems and the waiver process offer solutions to specific cases in which the current form of the boundary limit imposes inefficiencies. If this issue turns out to be significant, the rules regarding signal strength levels at boundaries can be amended at a later time. CTIA does not believe that adopting its proposal would lead to any significant increases in interference and does not believe that the Commission need consider any additional interference reduction or coordination mechanisms.

**Notice Issues**. In its *2002 Biennial Review NPRM*, the Commission noted that the historical rules limiting the transmitted power in the PCS service did not match current technologies and proposed modifying those rules to better accommodate current technologies.[10] One modification proposed by the Commission was a revision of the rules to accommodate multi-carrier amplifiers. Specifically, the Commission asked parties to consider "alternatives, including whether or not a power spectral density limit (*i.e.*, power per unit bandwidth) would be more equitable and thus preferable than a per-carrier wording."[11] CTIA acknowledges that this proposal was made in a section of the *2002 Biennial Review NPRM* on Part 24 rule changes, but the Commission did seek comment on whether provisions in Parts 1, 22, 24, 27, and 90 of the Commission's rules should be "harmonized because they treat similarly situated services differently."[12] Having directly proposed to restate base stations EIRP limits based on power spectral density and having sought comment on harmonizing those rules to ensure that they are technology neutral, the Commission does not need to seek comment again on the same proposal.

Moreover, several commenters supported moving to a limit formulated in terms of a power-spectral density.[13] Powerwave Technologies has recently voiced its support for CTIA's proposal.[14] According to Powerwave, by stating the proposed

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[10] *See 2002 Biennial Regulatory NPRM*, 19 FCC Rcd 708, para. 18.

[11] *Id.* We also note that Powerwave Technologies filed a Petition for Reconsideration of the Advanced Wireless Service Report and Order asking for harmonization of Part 24 and 27 based station power limits. *See* Petition for Reconsideration Filed by Powerwave in WT Docket No. 02-253 (filed Mar. 8, 2004). Moreover, the Commission recently sought comment on base station power limits in Part 27 of the Commission's rules. *See In the Matter of Service Rules for Advanced Wireless Services in 1915-1920 MHz, 2020-2025 MHz and 2175-2180 MHz Bands*, WT Docket No. 04-356, *Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, WT Docket No. 02-353, Notice of Proposed Rulemaking, FCC 04-218, paras. 110, 112 (rel. Sept. 24, 2004).

[12] *See id.* at para. 4.

[13] Comments of Motorola, April 23, 2004, at 2-5; Comments of Lucent, April 23, 2004, at 2; Comments of QUALCOMM Incorporated, April 23, 2004, at 7-9.

[14] *See* Letter from Terry G. Mahn, Counsel for Powerwave Technologies, Inc., to Marlene H. Dortch, FCC, filed December 29, 2004.

limit in the alternative, the CTIA proposal addresses Powerwave's initial concern that such a change would require existing narrowband systems to reduce power output.[15]

The CTIA proposal, by better matching the wording of the rules to today's technology, offers significant benefits at essentially no cost or risk. Naturally, the CTIA proposal raises a variety of questions regarding measurement, potential interference, RF exposure, boundary limits, and other topics. Most of these questions have a simple answer: the CTIA proposal does not permit an increase in the total EIRP that a PCS base station can transmit—rather it removes limits on some technologies. The CTIA proposal is worded in the alternative in order to permit continuation of the higher-powered operations allowed under the current rules. Finally, CTIA's proposal represents a compromise of proposals submitted previously in this proceeding and is supported by carriers and manufacturers across technology platforms. CTIA, therefore, urges the Commission to move expeditiously in adopting these much needed and overdue rule changes in the upcoming *2002 Biennial Review Report and Order*.

Pursuant to Section 1.1206(b) of the Commission's rules, an electronic copy of this letter is being filed. Should you have any questions about this proposal, please do not hesitate to contact the undersigned.

Sincerely,

/s/ *Paul Garnett*

Paul Garnett
Director, Regulatory Policy

cc: John Muleta
Ed Thomas
Peter Tenhula
David Furth
Julius Knapp
Bruce Franca
Tom Stanley
Greg Vadas
Ira Keltz
Ron Chase
Roger Noel
Lloyd Coward
Ahmed Lahjouji
Jay Jackson

[15] *See id.* at 1.

Wilbert Nixon